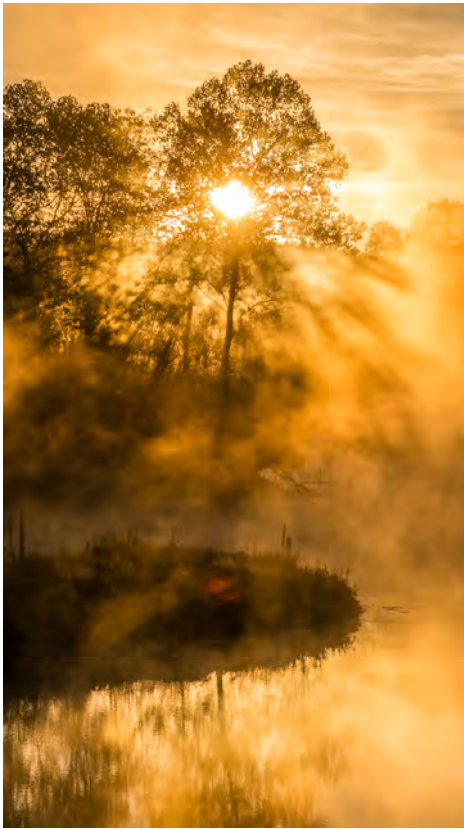


# Missouri Resources

Summer 2018 • Volume 35 • Number 3







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**ABOVE**  
**Fog rises off the water just after sunrise at Finger Lakes State Park, near Columbia.**  
MoDNR PHOTO BY BEN NICKELSON

**ON THE FRONT COVER**  
**The yurt at Table Rock State Park, near Branson, is the definition of “glamping.” The large tent-like structure is complete with amenities similar to a stay in a hotel.**  
MoDNR PHOTO BY BEN NICKELSON

**ON THE BACK COVER**  
**Paddle MO participants check supplies and prepare to launch for an afternoon of fun and education on the Missouri River.**  
MoDNR PHOTO BY ROB HUNT

## CONNECT WITH MoDNR



## CONNECT WITH MISSOURI STATE PARKS



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**ABOVE**  
**Young equestrians enjoy a trail ride just outside the stables at Lake of the Ozarks State Park, near Osage Beach.**  
MoDNR PHOTO BY BEN NICKELSON





# TICK-BORNE DISEASES PREVENTION IS THE KEY

by Brian Quinn

**I**N 1736, BENJAMIN FRANKLIN FAMOUSLY SAID, “AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE.” AND THOUGH HE WAS ACTUALLY REFERRING TO FIRE SAFETY AT THE TIME, FRANKLIN’S QUOTE HAS SINCE BECOME AN AXIOM OF PERSONAL AND PUBLIC HEALTH.

While the old adage is widely applied, there are few health issues where it is more relevant than tick-borne disease. Now that Missouri’s ticks are on the move again, everyone would be wise to follow Franklin’s sage advice and take steps to avoid tick bites and tick-borne illness.

## SIGNS AND SYMPTOMS

According to public health officials, symptoms of tick-borne disease vary among individuals and infecting agents. Symptoms generally include a sudden high fever, severe headache, muscle or joint aches, nausea,

**(Opposite page)** Hikers are at greater risk of coming into contact with ticks on narrow trails with extensive vegetation. Long sleeves and pants may not always be practical during summer, so use repellent and inspect for ticks frequently while outdoors.

MoDNR FILE PHOTO

**(Right)** Keeping grass mowed short will reduce the number of ticks; and be sure to wear bug repellent while mowing.



MoDNR PHOTO BY ANDREW RICHMOND



# AN OUNCE OF PREVENTION

## PRECAUTIONS TO PREVENT TICK BITES:

- Use an insect repellent with at least 20 percent DEET, picaridin or IR3535 on exposed skin and clothing. Choose a product that lasts several hours. Carefully follow label instructions.
- When possible, wear protective clothing (light-colored, long-sleeved shirts and pants) when outdoors.
- Avoid tick-infested areas including brush, tall grass, wood piles and leaf litter. Stay near the center of the trail when hiking.
- Reduce ticks around your home by keeping lawns mowed short, shrubs and trees trimmed, and by removing debris from yards.
- Check yourself, children and other family members for ticks every two to three hours while outdoors. Inspect clothing, as well as popular attachment sites such as the scalp, around the head and neck, under arms and groin area. If possible, change clothes and shower soon after going indoors.
- Regularly check pets for ticks. Pet owners should discuss tick prevention with their veterinarian.
- If you find an attached tick, remove it promptly. The longer it stays attached the greater the risk of infection.



(Left) There are a variety of choices for tick repellents available at most grocery, retail and convenience stores.

(Above) Some products include picaridin as an effective, odorless and non-greasy alternative to DEET.

vomiting or diarrhea. Symptoms typically begin within two weeks of a bite by an infected tick. Because most Missouri cases occur in May, June and July, anyone with flu-like symptoms in the summer should consult their doctor about the various tick-borne illnesses.

Tick-borne diseases can be serious and lead to further complications, especially for senior adults and people with chronic health problems. The good news is that not all ticks carry disease, and not all tick bites lead to illness. And, most of Missouri's tick-borne illnesses can be successfully treated if caught early.

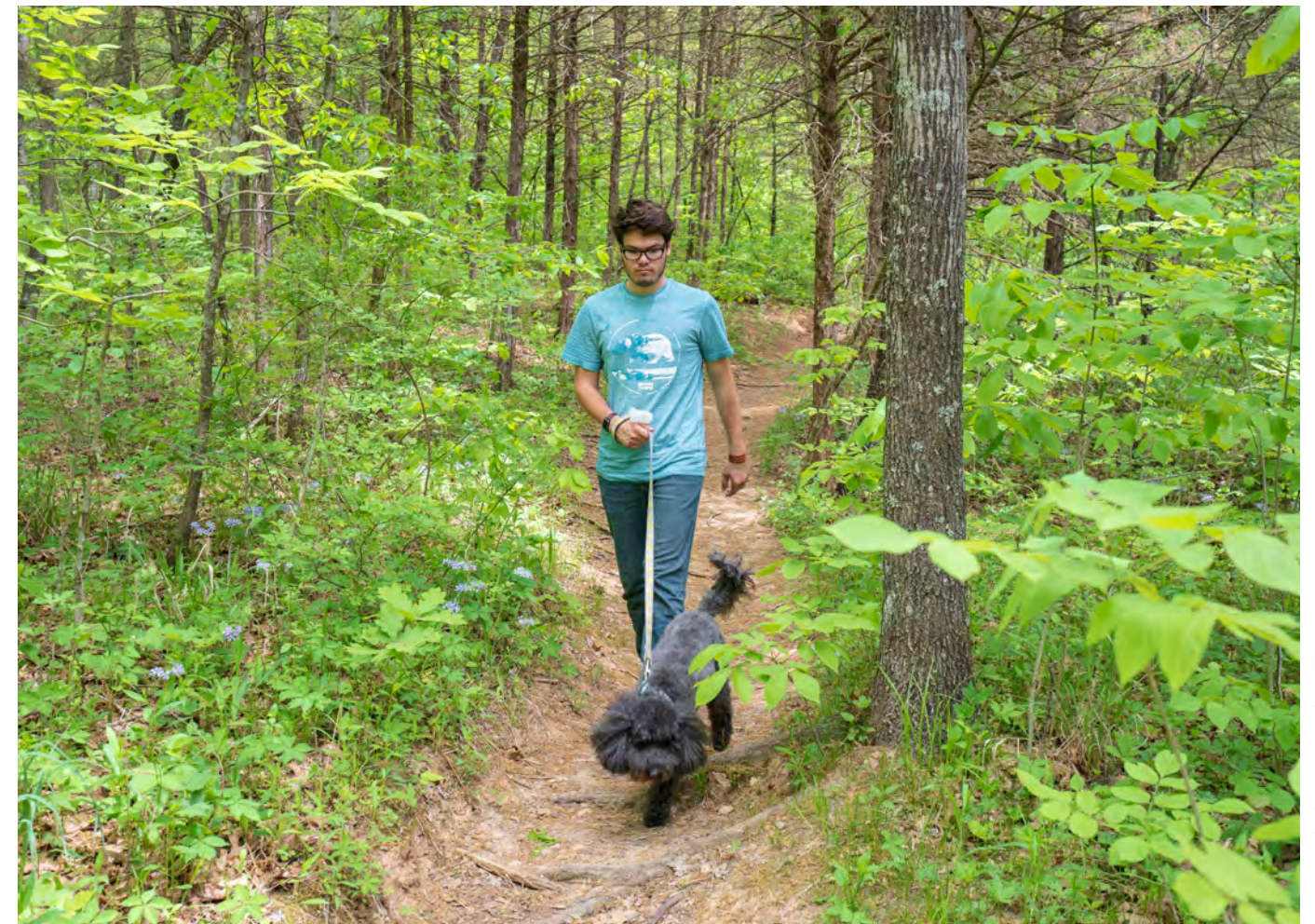
For more information visit [health.mo.gov/ticks](http://health.mo.gov/ticks).

*Brian Quinn is the division information officer for Missouri State Parks, a division of the Missouri Department of Natural Resources.*

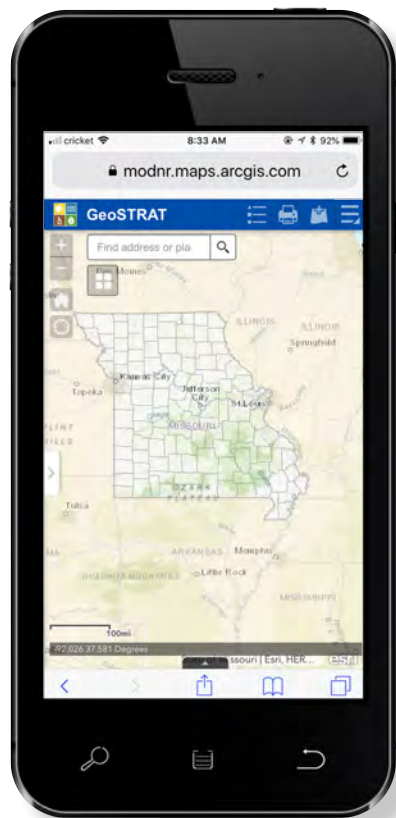


(Above) To remove a tick, use tweezers to grab as close as possible to the tick's head. Pull upward, slowly and firmly, until removed.

(Below) Be sure to check pets for ticks regularly, and consult a vet about available preventative treatments for cats and dogs.







# GeoSTRAT Goes Mobile

by Hylan Beydler

**T**he department's online Geosciences Technical Resource Assessment Tool, known as GeoSTRAT, recently received a significant upgrade. This web-based, interactive tool now makes geologic and geotechnical data readily available on mobile devices.

Since 2015, information provided in GeoSTRAT has aided business and industry professionals when they needed to know the geologic character of a particular area, when conducting complex geotechnical site evaluations, when preparing environmental site assessments, and more.

"Given advances in technology and the popularity of GeoSTRAT among citizens, business, industry, academia and others, the department recently moved from a component-based approach, where only certain web browsers could be

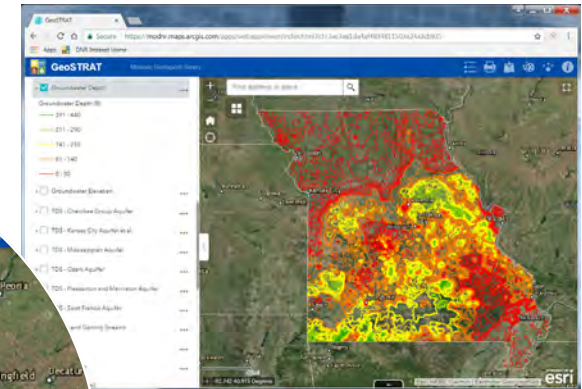
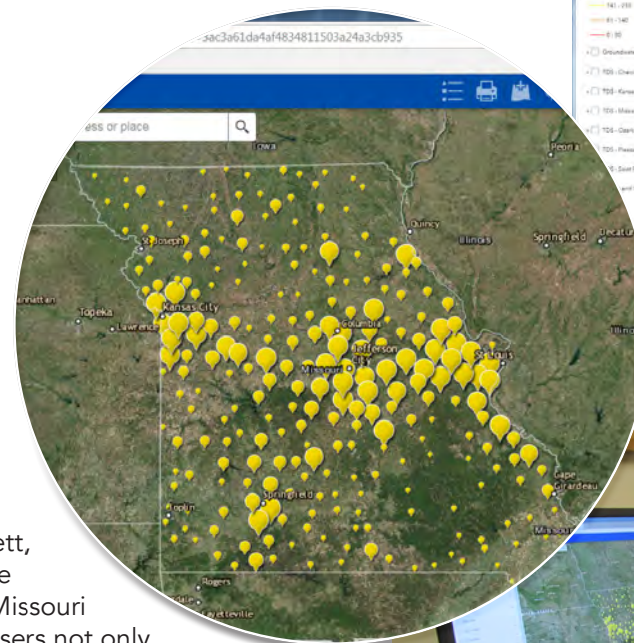
used and users were required to download and install a plug-in, to a standalone service using Esri technology," said Jerry Prewett, deputy director and assistant state geologist with the department's Missouri Geological Survey. "This means users not only can access the tool on mobile devices, they also can use any web browser."

GeoSTRAT lets users navigate anywhere in the state to see aerial views of the landscape. The tool also continues to provide immediate access to abandoned mine and sinkhole locations, springs, groundwater depth, certified water wells, cave density and other features and information.

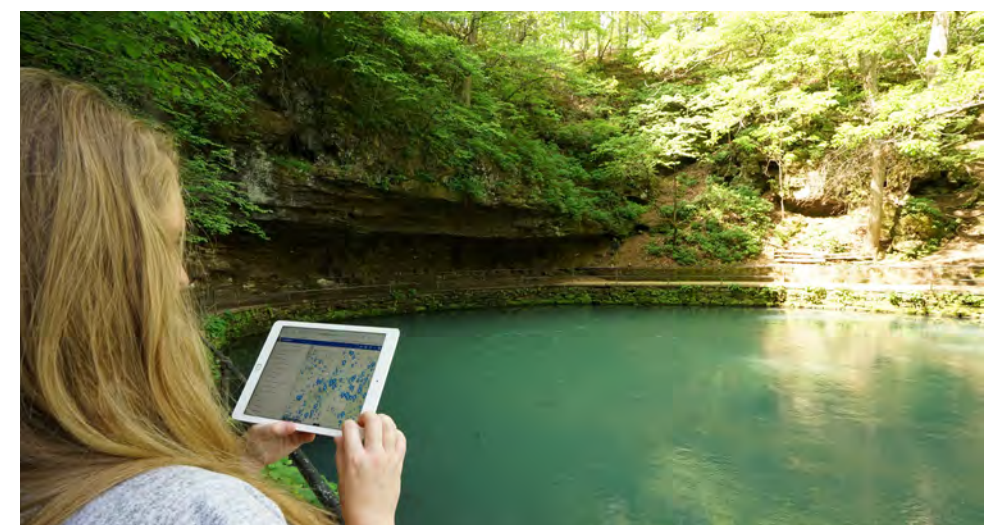
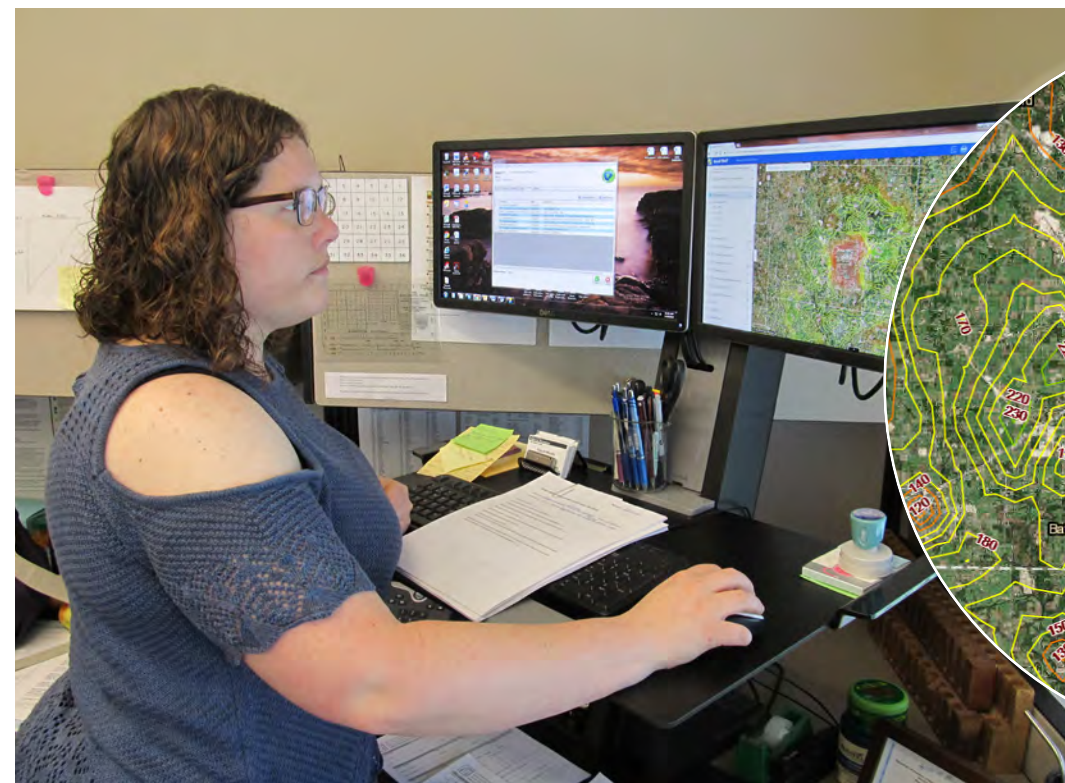
Having immediate access to geologic and hydrologic information is especially invaluable after natural or man-made disasters occur. GeoSTRAT has been used for data assessments in various disciplines such as hazards assessment, environmental consulting and engineering, local and regional planning, insurance assessment and others.

Data also may be downloaded and used in free and commercial mapping software. Try GeoSTRAT online at [dnr.mo.gov/geology/geostrat.htm](http://dnr.mo.gov/geology/geostrat.htm).

*Hylan Beydler is the division information officer for the Missouri Geological Survey, a division of the Missouri Department of Natural Resources.*



(Below and inset) Tracey Mason, a geologist with the department's Missouri Geological Survey, uses GeoSTRAT to display groundwater depth information for Springfield and the surrounding areas.



(Top) GeoSTRAT contains groundwater depth information for the entire state of Missouri. (Middle and inset) Brad Mitchell, a geologist with the department's Missouri Geological Survey, uses GeoSTRAT to display heat pump well locations throughout the state. (Above) MGS geologist Vicki Voigt uses an iPad to gather information while doing research at Meramec Spring, in Phelps County, the fifth largest spring in Missouri.



A Salute to

# WATER AND WASTEWATER OPERATORS

by Darlene Helmig

MoDNR PHOTO BY BEN NICKELSON



(Above) Plant operator Anna Zerr monitors a wastewater lift station in Fulton.

(Above right) Jacob Schwoerer, a lab analyst at the Jefferson City Wastewater Treatment Plant, tests wastewater for dissolved oxygen and pH.

MoDNR PHOTO BY ALICIA WIEBERG



MoDNR PHOTO BY BEN NICKELSON

(Left) A wastewater operator at the City of Fulton Wastewater Treatment Plant takes a sample. (Below) The water tower at the Jefferson City Drinking Water Treatment Plant stands tall above the city's northern border just south of the Missouri River.



MoDNR PHOTO BY DARLENE HELMIG

**T**hanks to the men and women who have chosen a career path to serve both their community and the environment at the same time. Becoming a certified water or wastewater operator takes a number of special skills, and all too often, their work goes unnoticed. Every time we enjoy a cool glass of tap water or reflect on the beauty of a clear stream or lake, we also should take a moment to think about the industry professionals who work behind the scenes to make a positive difference. Communities rely on them to operate equipment worth millions of dollars to provide safe drinking water and properly treated wastewater for their customers.

A career path as a certified operator in the water and wastewater industry combines customer service with science, math, computer

and mechanical skills. A state certification program that includes an examination and continuing education requirements ensures that certified operators have demonstrated the necessary knowledge, skill and ability.

As water and wastewater operators retire, filling vacant positions may be a challenge for some Missouri communities. Employment demand could result in great opportunities for people in the job market for advancement, flexible work schedules, location, variety of utility size and technologies, technical training, negotiable wages and benefits.

This also is a career path where a college degree is valuable, but not a required qualification.



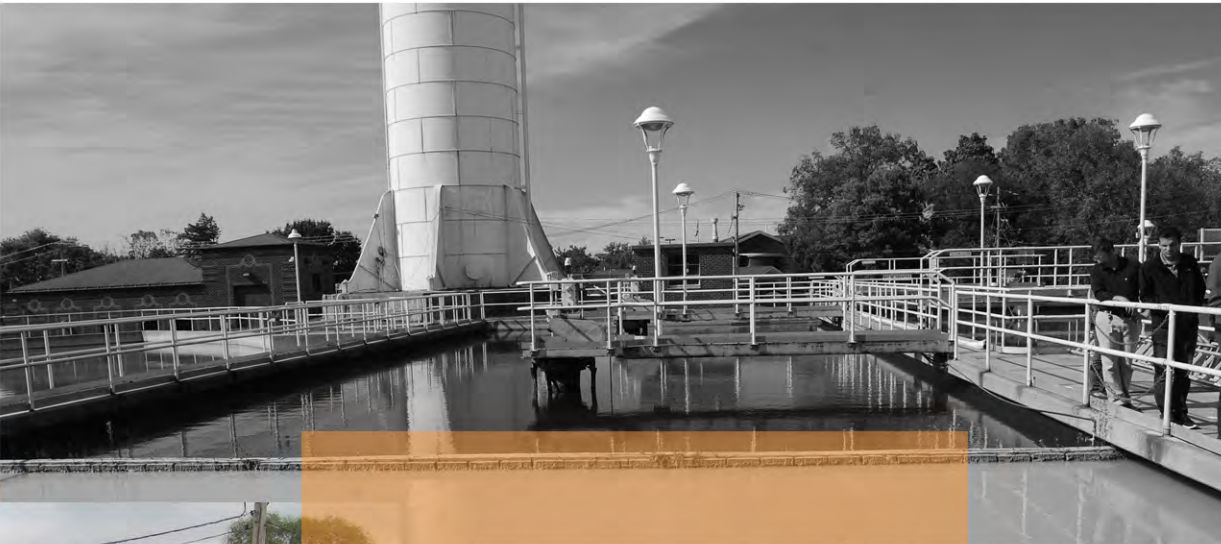


MoDNR PHOTO BY BEN NICKELSON



(Left) The City of Fulton Wastewater Treatment Plant.  
(Below left) The Jefferson City Drinking Water Treatment Plant.  
(Bottom) Anna Zerr monitors the aeration basin at the Fulton Wastewater Treatment Plant. Part of the secondary treatment process in a separate settling tank, bacteria forming the “activated sludge flocks” are continually recirculated back to the aeration basin to increase the rate of decomposition. The process uses oxygen and microbial action to reduce the pollutants during the wastewater treatment process.

MoDNR PHOTO BY DARLENE HELMIG



Thank you to our certified water and wastewater operators. Without you, our health would be negatively impacted, our communities and industries might not prosper, and our streams would most certainly suffer.

To find out more about becoming a certified operator, discover training opportunities or search for local certified operators, visit us online at [dnr.mo.gov/operator](http://dnr.mo.gov/operator).

*Darlene Helmig is chief of the department's Operator Certification Section in the Division of Environmental Quality.*

(Above) Garrett Kelley, an operator at the Jefferson City Wastewater Treatment Plant, cleans the compactor of debris collected from the bar screens at the facility's headworks.

(Right) Pictured is the drinking water clarifier at the City of Fayette Drinking Water Plant. Clarifiers are generally used to remove solid particulates or suspended solids from liquid during the drinking water treatment process.

MoDNR PHOTO BY DARLENE HELMIG



MoDNR PHOTO BY BEN NICKELSON



# Crinoid Missouri's Official State Fossil

Crinoids comprise a highly varied group of echinoderm invertebrate animals that have inhabited the shallow to abyssal marine environment from the beginning of the Ordovician Period of geologic time (490 million years ago) to present day. Crinoids have a plant-like appearance and are often called "Sea Lilies" because of that resemblance; however, they are not plants. Crinoids have a five-point radial symmetry and are related to other echinoderms such as the starfish, sea urchin and sand dollar. They are considered to possess the most complex anatomy of all marine invertebrates and like their starfish cousins, crinoids have been studied extensively because they can regenerate tissue, organs and even limbs.

Crinoids thrived during the Paleozoic Era (490 through 250 million years ago) and reached their apex during the Mississippian Period (360 through 320 million years ago). For millions of years, crinoids covered the ocean floor. Thousands of species of crinoids evolved and became extinct through geologic time. They, along with 96 percent of all marine life on the planet, perished during the mass extinction event called "The Great Dying," which occurred at the end of the Permian Period, roughly 251 million years ago.

Most often, crinoid fossils are found in limestone as dismembered pieces with their individual hard parts preserved. These parts of their bodies (called ossicles), consist of their segmented column ("stem" that resembles a stack of poker chips), segmented calyx ("cup" that contained vital organs), and ambulacra (segmented feeding arms) that radiated out from the calyx and were covered with cilia (tiny hairs). The bottom of the stem was equipped with a fingered holdfast used to attach the animal to the sea floor. They could release the holdfast and float along to a new location.

When fossilized crinoid stems weather out of the host rock, they often appear as tiny round discs of stone that may have a hole (often star-shaped) in their center. These discs resemble beads and can be strung as such. The Mississippian-Age Burlington Limestone, a rock formation found throughout Missouri, is renowned for its abundant crinoid fossils.

The crinoid *Delocrinus missouriensis* became the state's official fossil June 16, 1989, after a group of Lee's Summit school students worked through the legislative process to incorporate it as a state symbol.

## Crinoid

A fossil does not always represent a type of plant or animal that lived a long time ago and is now extinct. Missouri's most common fossil, a Crinoid is no longer abundant, but it does have more than 600 living relatives in the warm, clear waters of the Pacific and Indian oceans, and in the Caribbean Sea.

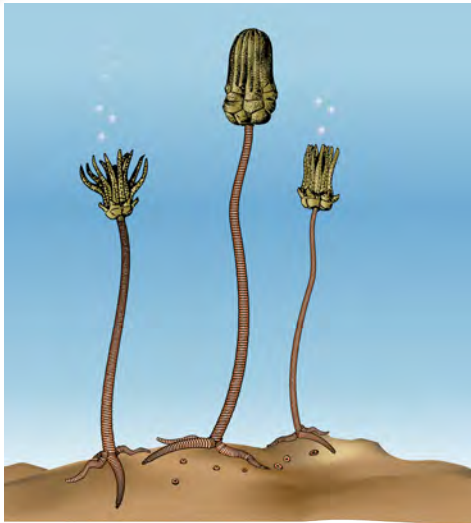


(Left) Pictured are a fossilized crinoid calyx and several pieces of the round segments of the column.

MoDNR PHOTO BY  
HYLAN BEYDLER

(Below) This drawing shows the feeding arms, calyx, column and holdfast of a living crinoid.

MoDNR ILLUSTRATION  
BY MARK GORDON



MoDNR PHOTOS BY BEN NICKELSON

# More Than 200 Streamgages Monitor Stream and River Levels in Missouri

Do you know what the chance of rain is tomorrow? Do you know what the chance of a flood is tomorrow? Much like your local meteorologist predicts what conditions to expect the next few days, Missouri's streamgage network is always working to gather information that helps the National Weather Service and others predict what our streams, rivers and lakes are going to do.

More than 200 gages monitor sites throughout our state. Nationally, the program contains more than 7,400 gauges. One of the most useful features of the network is its real-time capability and accessibility.

Many streamgages in Missouri not only collect information on height of the river, but also collect precipitation and discharge information. Information from streamgages is used by a wide range of stakeholders in Missouri. Streamgages provide

critical information before and during floods, which are among the most frequent and costly natural disasters. Much like a weather forecast, information from streamgages can provide accurate flood magnitude and crest forecasts, allowing municipalities and emergency responders to save human life and property. Recreation outfitters and the public use streamgages to determine if conditions are safe for canoeing and kayaking.

Streamgages also can provide valuable information to communities leading up to and during droughts to understand their water supply availability. Boat operators transporting goods on our large rivers use streamgages to determine how heavy the barges can be loaded, which may save transportation costs. Boat operators also use streamgages to ensure safety by determining whether there is enough water in the channel for safe transit.

In Missouri, our streamgage network is part of a collaborative effort between the Department of Natural Resources, the U.S. Geological Survey (USGS), other state agencies, municipalities and other partners. The network operates as part of the National Streamflow Network that USGS operates under the Groundwater and Streamflow Information Program.

Missouri-specific information can be found online at [waterdata.usgs.gov/mo/nwis/rt](http://waterdata.usgs.gov/mo/nwis/rt). Sign up to receive alerts at: [maps.waterdata.usgs.gov/mapper/wateralert](http://maps.waterdata.usgs.gov/mapper/wateralert).

(Top left) The CCC tower at Bennett Spring State Park, in Lebanon, also plays host to streamgage hardware, which is visible on the right side of the structure. (Top right) Streamgages like the one at Bennett Spring State Park are automated and transmit data back to the USGS where it can be accessed online in real time.



# Angela Carson

Missouri State Park Ranger,  
Missouri Department of Natural Resources,  
Division of State Parks



MoDNR PHOTO BY BEN NICKELSON

**Please introduce yourself and tell us how long you’ve been working for the Department of Natural Resources.**  
I’m Angela Carson and I’m a Missouri State Park Ranger. I’ve been with the department for 2½ years.

**Where do you work, and what are your job duties?**  
I am based at Meramec State Park in Sullivan and my job is to enforce any state laws or park rules to ensure that our parks remain safe for any of our visitors.

**What is your job like on a daily basis?**  
It varies, anywhere from traffic stops for people who are speeding, to keeping an eye out for drunk drivers. I’ll spend a lot of time building relationships with park visitors, particularly children, our younger generation, to make sure they enjoy their visits and have a good time so that in the future, they keep coming back.

**What do you like best about your job?**  
I enjoy the relationship building with park visitors. There is a noble cause in making sure everybody stays safe, and that families know they can come here without worry; they can relax and build memories for a lifetime.

Watch Carson’s interview on YouTube.



**How does your job help enhance and protect Missouri’s natural resources?**  
We have some of the best state parks in the nation, and I’m honored to be a part of ensuring that those are maintained and preserved so that our citizens and even people from around the country can come and enjoy them. It is nature at its best and to keep that safe and protected is something I enjoy a great deal.

**What would you tell someone who was thinking about a job at MoDNR? Why should they want to work for us?**  
There’s an amazing thing about the whole agency and how positive the culture is to work here. There is a standard of excellence that we carry and always an open door to follow your passion. So, if your passion is in the outdoors or environment, or preserving our parks, or you are interested in law enforcement, this is a place you can do that. And you’ll be in an agency that actually supports and facilitates you doing what you love.

**What is it like to be selected as Missouri’s Park Ranger of the Year?**  
A very, very humbling experience. A nomination from other rangers and our command staff, and a bit embarrassing, but yeah, what an honor. Again it just goes back to what our leadership is like; they expect excellence and reward that and support us in so many ways. So, it’s easy to do a really great job in this environment, and so yeah, very, very humbled by that experience.

**Is there anything else you’d like to add that you think a reader should know?**  
We love having people in our parks, and even when I may be pulling you over to have you slow down or whatever, it really is about building a relationship with people and keeping them safe, even when they may be making bad decisions. But, we’re glad people are here; we’re glad that they’re visiting our parks and enjoying nature at its finest.

Go to [dnr.mo.gov/hr](http://dnr.mo.gov/hr) and join a great team, start a great career and achieve a great purpose.

(Top) Park Ranger Angela Carson enjoys relationship building opportunities with park guests at Meramec State Park, near Sullivan.  
(Left) Ranger Carson patrols park grounds to ensure guests stay safe, allowing them to enjoy their visit without worry, while relaxing and building lifetime memories.

MoDNR PHOTOS BY ANDREW RICHMOND



## Hit the Trails With Plan in Hand

by Brian Quinn

During your summer travels, it’s wise to view even a one-day trail excursion as a mini-vacation. You wouldn’t embark without a checklist of things to bring, places to go or the proper clothing and equipment for your vacation. Hiking, cycling and backpacking trips, even without an overnight stay, require no less for the wise and wary trail trekker. Read on for tips and considerations to plan for as you enjoy the beautiful trails of Missouri State Parks that crisscross our bountiful Show-Me State.

### Trail Rules and Etiquette

Things to know before you go:

- Missouri state park trails are generally open from sunrise to sunset. Some parks have gates that close every evening.
- Ticks, chiggers and mosquitoes are common in Missouri from April through October. Be prepared with insect repellent.

(Top) A family hikes with a trail map in hand along Acorn Trail at Ha Ha Tonka State Park, near Camdenton.  
(Right) The trail sign for Gans Creek Wild Area Trail at Rock Bridge Memorial State Park, Columbia, lists trail rules and conditions you might experience while hiking the trail.







- Know your physical capabilities when choosing a trail.
- Always carry water to ensure you stay hydrated. Watch the weather and dress appropriately.
- Read the information on the trailhead signs and maps to become oriented and aware of the trail terrain, length and special features.

Trail Rules

Please help to maintain and preserve the beauty of Missouri State Parks trails by following these rules:

- Only hikers, equestrians, bicyclists and backpackers, as designated, are permitted on the park trails.
- All pets must be kept on a leash for their protection and that of other visitors and wildlife.
- Removal of plants, animals, rocks, downed timber, artifacts or relics is prohibited.
- Cutting implements such as saws and hatchets are not allowed on trails.
- No hunting or discharging of firearms is permitted.
- All other rules and regulations pertaining to park use are applicable to trail users.

Additional Rules for Backpacking Trails

- All backpackers must register at the trailhead or park office before starting their trip.
- Groups of seven or more persons are permitted to camp only in designated areas. While smaller groups are not required to use the designated areas, they must camp at least 100 feet from the trail, 200 feet from any major public use area, and at least one-fourth mile from the trail entry/exit point.
- Campfires are prohibited unless there is a designated backpacking campsite where a fire ring has been provided. On most trails, stoves will be needed for cooking.



The Ethics of Good Trail Use

- Carry out what you carry in. If the trail users before you have not done this, you can help by removing their trash, too.
- Keep your group small. Small groups are less likely to harm the environment.
- Dispose of human waste properly. The top 6 to 8 inches of soil provide a system of biologic disposers that decompose organic material. Hikers should select a spot at least 100 feet from any open water; dig a small hole no deeper than 6 or 8 inches. After use, fill the hole with loose soil and tramp in the sod. Nature will do the rest.
- Stay on the trail. Do not take shortcuts. The trail has been laid out to minimize destruction of surrounding vegetation and to prevent erosion
- Avoid using a trail when wet.

# Leave No Trace

Missouri State Parks is a proud partner of the Leave No Trace Center for Outdoor Ethics and believes that we all share in the stewardship of America’s public lands. Join in our work to leave no trace by following the Leave No Trace Seven Principles.®



Leave No Trace™  
Center for Outdoor Ethics | LNT.org

- Plan ahead and prepare.
- Travel and camp on durable surfaces.
- Dispose of waste properly.
- Leave what you find.
- Minimize campfire impacts.
- Respect wildlife.
- Be considerate of other visitors.

Remember, you’re always welcome in Missouri State Parks!  
For more information, visit [mostateparks.com](http://mostateparks.com).

*Brian Quinn is division information officer for Missouri State Parks, a division of the Missouri Department of Natural Resources.*

(Opposite page, far left) While backpacking, campfires are prohibited except in designated fire rings.

(Opposite page, top) Pets must remain on a leash at all times on Missouri State Park trails.

(Opposite page, bottom) While hiking, carry out what you carry in and if you find trash along the way, please collect it.



(Above) Hikers at Clark’s Hill/Norton State Historic Site, near Jefferson City, were prepared for their trail adventure by bringing water and dressing in layers.  
MoDNR PHOTOS BY BEN NICKELSON



# TOP SPOTS TO ENJOY HORSEBACK RIDING

Horseback riding is a great way to get out and see some of Missouri's beautiful backcountry, and its popularity is growing annually. In response, Missouri State Parks is working to make more of our trails available and attractive for equestrian use. Currently, horseback riders (and their horses) are welcome at 16 of Missouri's state parks where equestrian trails wind through stunning Missouri wilderness settings. Here is just a sampling.

Lake of the Ozarks State Park, in Camden and

Miller counties, has three equestrian trails, including the 13.5-mile Trail of Four Winds. The longest in the park, this trail travels through almost every type of the park's natural communities. This diversity provides stunning views of the lake, rock outcrops, seasonal streams, ponds and woodlands.

Equestrians can ride 12.75 miles of the Lake Wappapello Trail, in Carter County, where they will find challenges and inspiration as they traverse the rugged Ozark terrain. The trail offers shoreline

views, open fields and cherty Ozark hillsides with plenty of wildlife. Riders can enjoy some of the state park system's most spectacular scenery on the 10-mile Goggins Mountain Equestrian Trail at Johnson's Shut-Ins State Park in Reynolds County. The trail passes through a 5,000-acre wild area.

Visit [mostateparks.com/activity/horseback-riding](http://mostateparks.com/activity/horseback-riding) for more information about equestrian trail opportunities.



MoDNR PHOTO BY BEN NICKELSON



MoDNR PHOTO BY BEN NICKELSON



MoDNR PHOTO BY STACY BANDELIER

(Above) Ozark Homestead Riding Stable in Lake of the Ozarks State Park offers horsemanship classes through its concessionaire.

(Above left) Equestrians groom their horses after a trail ride at the Trail of Four Winds trailhead in Lake of the Ozarks State Park.

(Left) Horses are permitted on the Katy Trail from Clinton to the Missouri State Fairgrounds in Sedalia, and from Tebbetts to Portland.

(Opposite page) St. Joe State Park features two equestrian trails, as well as a campground designated for equestrians.

MoDNR PHOTO BY BEN NICKELSON

(Opposite page, bottom) A young rider gets ready to hit the trail on horseback at Lake of the Ozarks State Park.

MoDNR PHOTO BY BEN NICKELSON

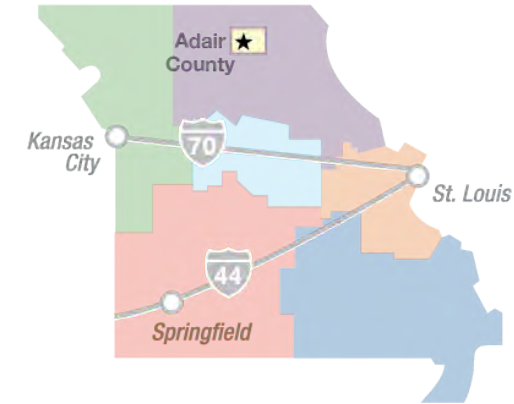


trailhighlight

The FLATS

at Thousand Hills State Park

trailhighlight



The Forest Lake Area Trail System (FLATS) is located inside Thousand Hills State Park.

The trail is an effort to construct a four-mile, paved, multi-use trail that connects Thousand Hills State Park and the city of Kirksville. Completed in 2015 as the first phase of a larger project, the trail currently is about .6 miles long and begins at the parking lot near the dining lodge. FLATS soon will begin construction of a .7-mile section on the south side of Missouri Street in Kirksville.

When finished, Forest Lake Trail will be four miles long and will run through the heart of Thousand Hills State Park, connecting the

marina, dining lodge, cabins, swimming beach and petroglyph site. This concrete hiking and bicycling trail is accessible to wheelchairs and strollers, and features views of Forest Lake along the entire route.

**Thousand Hills Trail**

Thousand Hills Trail, also located within the park, is a hiking, biking and backpacking trail that covers 10.5 miles. The trail passes through and along savanna restoration units, with sections that skirt Forest Lake. Its natural surface and route through hilly, rugged wooded terrain make the trail popular with mountain bikers.

The area’s natural beauty can be seen in the rolling upland areas of the park, which are covered with second-growth forests of white oak, northern red oak and shagbark hickory. Other species can be found in the bottomland along the Chariton River, along with white-tailed deer, wild turkey, beaver, raccoon, red fox, and several bird species.

Thousand Hills Trail was developed as a cooperative project of the Community Betterment Association of Kirksville, the Missouri Department of Conservation and the Missouri Department of Natural Resources. The trail traverses both the Big Creek Conservation Area and Thousand Hills State Park.

(Opposite page) The trailhead near the marina crosses a bridge that features cutout designs based upon petroglyphs found in the park.

(Top, center) The first phase of the trail was completed in a partnership between MoDNR and the Forest Lake Trail System (FLATS), a group of local citizens who donated time and money to bring the project to life. A sign listing the founding donors is located at the trailhead.

(Top) Forest Lake Trail has a short spur that leads to a petroglyph site where visitors can view ancient Native American carvings.

(Above) The smooth concrete surface of the trail is perfect for an easy stroll or bicycle ride, and is wheelchair accessible.

(Above, left) Thousand Hills Trail passes through and along savanna restoration units, and at times, along Forest Lake.

MoDNR PHOTOS BY BEN NICKELSON



butnot least

2018 303(d) List

# Public Comment Period on Impaired Waters of Missouri

The Missouri Department of Natural Resources is accepting public comment on the 2018 303(d) Impaired Waters List.

Section 303(d) of the federal Clean Water Act requires each state to identify waters that are not meeting water quality standards and for which adequate water pollution controls have not been required. Water quality standards protect beneficial uses of water for whole body contact recreation (such as swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife. The 303(d) list helps state and federal agencies keep track of waters that are impaired. The department must biennially submit a list of impaired or threatened water bodies to the U.S. Environmental Protection Agency during even-numbered years. The 2018 303(d) List, approved by the Missouri Clean Water Commission on Jan. 4, 2018, is available for public review and comment. The public notice period began April 24, 2018, and ends July 23, 2018.

The Missouri Clean Water Commission will hold a hearing for the public to provide comments on the Missouri 2018 Section 303(d) Impaired Waters List during its July 16, 2018, meeting at 10 a.m. in the Lewis and Clark State Office Building, 1101 Riverside Drive, Jefferson City. Go to this link for a map to the location: [dnr.mo.gov/shared/maps/jeffcity.pdf](http://dnr.mo.gov/shared/maps/jeffcity.pdf).

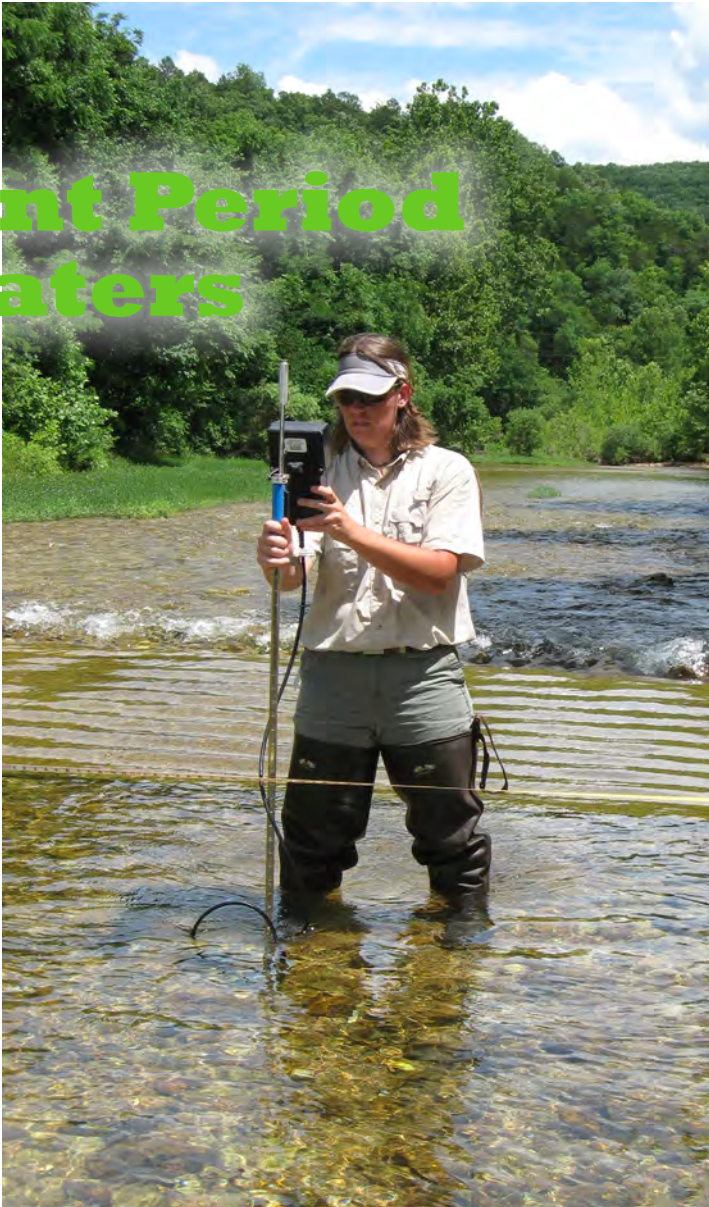
The department previously held public availability meetings for the Missouri 2018 Section 303(d) Impaired Waters List on May 10, 2018, and May 24, 2018, in Jefferson City. These meetings allowed the public to ask questions about the 303(d) Impaired Waters List.

The public may submit comments in writing until 5 p.m. July 23, 2018, to the Department of Natural Resources, Attn: Robert Voss, Water Protection Program, PO Box 176, Jefferson City, MO 65102-0176 or by email to [robert.voss@dnr.mo.gov](mailto:robert.voss@dnr.mo.gov).

**Missouri Impaired Waters List**

[dnr.mo.gov/env/wpp/waterquality/303d/303d.htm](http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm)

You can go to this link and click on 2018 List of Impaired Waters.



MoDNR PHOTO BY DAVID GULLIC



MoDNR PHOTO

(Top) Monitoring staff determine streamflow by measuring stream width, depth and velocity.  
(Above) A quality control check is conducted on a data sonde that collects 24-hour, in-stream dissolved oxygen and temperature measurements.

# Paddle MO

5 DAYS 100 MILES

**5 Days • 100 Miles**  
Hermann, Mo. to the Confluence  
**September 19-23, 2018**

- Experience the wild beauty of North America's longest river
- Explore, Enjoy, Relax – this is not a race
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**Register by July 15 at [PaddleMO.org](http://PaddleMO.org)**

Weekend-only trip Sept. 22-23 also available  
Email: [info@streamteamsunited.org](mailto:info@streamteamsunited.org)

A group of people are gathered on a riverbank, some standing and some sitting in canoes. The background shows a lush green forest.

[dnr.mo.gov](http://dnr.mo.gov)